APPENDIX H

DEMAND ESTIMATE METHODOLOGIES

Described in this appendix are the methodologies developed and applied to estimate travel demand along the marine and roadway links proposed as part of this planning effort. The demographic projections upon which they are based were prepared by Oliver Goldsmith at the Institute for Social and Economic Research at the University of Alaska.

TABLES

MARINE DEMAND FORECASTS

DEDICATED *TUSTUMENA* MARINE SERVICE

Note that service demand for a dedicated *Tustumena* alternative was estimated differently, and separately, from the other marine alternatives described herein. This is because dedication of the *Tustumena*, a vessel already in service, to Southwest Alaska ports already served by the AMHS, represents an adaptation of existing service, rather than a wholly new service concept. As such, the Glosten Associates used past demand levels as a basis upon which to forecast future service demand under changed conditions (e.g., demographics, frequency, and seasonality of service).

The methodology used by the Glosten Associates to predict travel demand for a dedicated Tustumena alternative is based on earlier work, by Northern Economics, documented in *Break-Even Demand on Alternative Ferry Systems in Lynn Canal* (February 1999). This study considered the elasticity of demand for ferry travel based on an increase in the availability of service. Although a similar demand elasticity analysis has not been performed for Southwest Alaska, the same principles are presumably transferable.

In contrast, demand for marine service concepts that are wholly new (e.g., Lake Iliamna–Kvichak River) have had to be based on a statistical models that rely on data from Southwest Alaska other ports and populations to forecast demand using new types of vessels to communities with no track record with AMHS service.

HOMER–SELDOVIA–WILLIAMSPORT MARINE SERVICE

The Homer–Williamsport element of the Cook Inlet to Bristol Bay Corridor alternative represents wholly new service. As such, demand for this alternative was estimated based on the methodology developed earlier in this planning effort and documented in *Southwest Alaska Transportation Plan Travel Demand Forecasts Technical Memorandum* (May 1998). Since this concept involves three separate ports, demand generated by each port was estimated separately and then summed. The 2020 base population and base per capita income figures were taken from the ISER projections prepared as part of this study effort. The model used to forecast demand for AMHS service is based on the following equation:

Annual AMHS Trips/Average Annual Port Calls = [(0.154)(2020 Base Population)] + [(0.000895)(2020 Base per capita Income)]

To calculate demand for Williamsport, a place without any permanent population, the populations of Iliamna, Pedro Bay, Igiugig, and Newhalen were combined and multiplied times the number of port calls envisioned for this service. This calculation assumes that the Williamsport-Pile By roadway alternative, as well as the Iliamna-Pedro Bay-Pile Bay roadway alternative are also implemented. Because Homer is connected to Anchorage and to the rest of Alaska's overland transportation system, it is assumed that Homer will not generate much of the travel demand (other than perhaps tourist traffic). Accordingly, Homer was not treated as a generator of travel demand in this estimate. The resulting planning-level demand estimate for this alternative is 8,200 passenger trips per year.

Vehicle demand was estimated using a regression equation developed by the Glosten Associates. This mathematical relationship was developed statistically, using per capita vehicle demand data from AMHS ports in Southwest Alaska. These data were taken from the AMHS database. The equation used to estimate vehicle demand rates, which were applied to the passenger demand rates just described, was as follows:

Vehicle demand per passenger carried = 0.0120 + (0.0026 * port calls per year)

However, a caveat is in order. Because the dataset upon which this equation was developed had a maximum number of port calls of 127 per year, it would not be appropriate to assume that the statistical relationship between passengers and vehicle demand holds beyond the data range over which it was calculated. Therefore, the highest vehicle demand rate, that associated with 127 port calls per year, is used in calculating vehicle demand for this alternative, which would actually have 308 port calls per year. Applying this maximum vehicle per passenger rate (0.32) to the passenger trip estimate derived earlier, produces an annual vehicle demand forecast for this alternative of 2,800.

Table 1
Homer–Seldovia–Williamsport Marine Service
Passenger and Vehicle Demand Estimate

Homer-Seldovia Element

	2020 Base Pop	2020 Base Income	Port Calls*	Demand
Homer*	5576	$36,552	127	4,241
Seldovia	349	$27,500	127	3,808
Total Trip Ends				8,049
Passenger demand = trip ends/2				4,024
Vehicle demand per capita rate = 0.0120+(0.0026*port calls)				0.3422
Vehicle demand = vehicle demand rate * passenger demand				1,377

Williamsport Element

	2020 Base Pop	2020 Base Income	Port Calls*	Demand
Iliamna	128	$16,444	127	2,127
Pedro Bay	45	$16,444	127	1,960
Igiugig	68	$16,444	127	2,006
Newhalen	218	$16,444	127	2,308
			SUM	8,400
Passenger demand = trip ends/2				4,200
Vehicle demand per capita rate = 0.0120+(0.0026*port calls*)				0.3422
Vehicle demand = vehicle demand rate * passenger demand				1,437

SUM Total	Passengers	Vehicles
Homer-Seldovia Element	4,024	1,377
Williamsport Element	4,200	1,437
	8,224	2,814

* No significant travel demand is anticipated to be generated from Homer,which is linked to the overland surface transportation network.

Equation used to predict trip ends: trip ends =[(0.01584*2020 base population)+(0.000895*2020 base income)]*port calls (althoughactual number of port calls is 308, use max value from model development (127). The result, trip ends, is divided by two to derive passenger trips.

For vehicle demand estimate, the equation used is as follows: vehicle demand/passenger = 0.0120 + (0.0026*port calls). Again, although actual port calls for this alternative are 308, use the max value from model development, which is 127. This rate is then multiplied by the passenger demand estimate to develop a vehicle demand estimate.

LAKE ILIAMNA–KVICHAK RIVER MARINE SERVICE

Shallow-Draft Landing Vessel Option

Service demand for this alternative was estimated by using the model developed earlier in this planning effort and documented in *Southwest Alaska Transportation Plan Travel Demand Forecasts Technical Memorandum* (May 1998). According to this model, AMHS travel demand can be estimated with reference to the following equation:

Annual AMHS Trips = [(0.0154)(2020 Base Population) + (0.000895)(2020 Base Income)] * Annual port calls

Accordingly, this equation was applied to the 2020 populations and income levels of the communities served: Iliamna, Pedro Bay, Igiugig, Newhalen, Levelock, and Naknek. The resulting travel demand estimate is 3,600 per year.

Vehicle demand per passenger carried was estimated with a model developed by the Glosten Associates that uses simple linear regression to relate per capita vehicle demand to the number of port calls per year. The number of port calls in this alternative, for the purposes of sketching a planning-level estimate, is 78 per year. The equation that was used to predict vehicle demand per capita is as follows:

Vehicle demand per passenger carried = 0.0120 + (0.0026 * port calls per year)

Given that the number of port calls per year for this alternative is 78, then the resulting rate derived for this alternative is 0.2148. When this rate is multiplied by the passenger demand estimate earlier derived (3,600), a vehicle demand estimate of 781 results.

Table 2
Lake Iliamna–Kvichak River Marine Service
Passenger and Vehicle Demand Estimate
(Shallow-Draft Landing Vessel Option)

Lake Iliamna-Kvichak River Marine Link—Shallow-Draft Vessel				
	2020 Base Pop	2020 Base Income	Port Calls	Demand
Iliamna	128	$16,444	78	1,306
Pedro Bay	45			0
Igiugig	68	$16,444	78	1,232
Newhalen	218	$16,444	78	1,417
Levelock	139	$16,444	78	1,320
Naknek	684	$16,444	78	1,993
			SUM	7,268
Passenger demand = trip ends/2				3,634
Vehicle demand per capita rate = 0.0120 + (0.0026*port calls)				0.2148
Vehicle demand = vehicle demand rate * passenger demand				781

Hovercraft Option

Service demand for this alternative was estimated by using the model developed earlier in this planning effort and documented in *Southwest Alaska Transportation Plan Travel Demand Forecasts Technical Memorandum* (May 1998). According to this model, AMHS travel demand can be estimated with reference to the following equation:

Annual AMHS Trips = [(0.0154)(2020 Base Population) + (0.000895)(2020 Base Income)]
***** Annual port calls

Accordingly, this equation was applied to the 2020 populations and income projections for the communities served: Iliamna, Pedro Bay, Igiugig, Newhalen, Levelock, and Naknek. The number of port calls for this option is 220, which is based on the fact that service is operable year-round, except for the estimated 40 days per year of freeze-up and thaw. However since the number of port calls envisioned in this option, at 220, greatly exceeds the maximum number of port calls in the Southwest Alaska dataset upon which the initial model was based, it would not be appropriate to assume that the relationship holds beyond the data rate upon which the model is based. So, rather than multiplying the income and population elements of the equation by the actual number of ports calls envisioned, these elements are multiplied against the maximum number of port calls upon which the dataset is based, which is 127. The resulting travel demand estimate is 6,900 per year.

Vehicle demand was estimate with a model developed by the Glosten Associates that uses a simple linear regression model to relate per capita vehicle demand to the number of port calls per year. The number of port calls in this alternative, for the purposes of sketching a planning-level option, is 220, which much exceeds the maximum value of the dataset upon which the equation was developed. Therefore, the

maximum rate that can be derived from this dataset is 0.3422, which is based on the maximum number of port calls within the study area, which is 127. This rate was derived from the following equation:

Vehicle demand per passenger carried = 0.0120 + (0.0026 * port calls per year)

When this maximum rate, 0.3422, is applied to the passenger demand estimate given earlier the resulting vehicle demand estimate is 2,360.

Table 3
Lake Iliamna–Kvichak River Marine Service
Passenger and Vehicle Demand Estimate
(Hovercraft Option)

Lake Iliamna-Kvichak River Marine Link—Hovercraft				
	2020 Base Pop	2020 Base Income	Port Calls	Demand
Iliamna	128	$16,444	127	2,127
Pedro Bay	45	$16,444	127	1,960
Igiugig	68	$16,444	127	2,006
Newhalen	218	$16,444	127	2,308
Levelock	139	$16,444	127	2,149
Naknek	684	$16,444	127	3,245
			SUM	13,794
Passenger demand = trip ends/2				6,897
Vehicle demand per capita rate = 0.0120 + (0.0026*port calls)				0.3422
Vehicle demand = vehicle demand rate * passenger demand				2,360

BRISTOL BAY MARINE SERVICE

Service demand for this alternative was estimated by using the model developed earlier in this planning effort and documented in *Southwest Alaska Transportation Plan Travel Demand Forecasts Technical Memorandum* (May 1998). According to this model, AMHS travel demand can be estimated with reference to the following equation:

Annual AMHS Trips = [(0.0154)(2020 Base Population) + (0.000895)(2020 Base Income)] * Annual port calls

Accordingly, this equation was applied to the 2020 populations and incomes of the communities served: Dillingham, Clarks Point, Togiak, Naknek, and Egegik.

Vehicle demand per passenger was estimated with a model developed by the Glosten Associates that uses a simple linear regression model to relate per capita vehicle demand to the number of port calls per year. This rate was derived from the following equation:

Vehicle demand per passenger carried = 0.0120 + (0.0026 * port calls per year)

When applied to the number of port calls envisioned for each port of call, and applied to the passenger demand estimate earlier derived, the resulting total vehicle demand for this alternative was estimated at 621.

Table 4
Bristol Bay Marine Service
Passenger and Vehicle Demand Estimate

Bristol Bay Marine Service				
	2020 Base Pop	2020 Base Income	Port Calls	Demand
Dillingham	2749	21903	63	3,978
Clark's Point	79	21903	84	1,752
Togiak	953	21903	21	729
Egegik	167	16444	21	365
Naknek	849	37103	21	980
				7,803
			Trip ends/2	3,902
Port calls for Bristol Bay based on a 21-week service year.				
Vehicle Demand Estimate = 621				

INTRA-KODIAK BOROUGH MARINE SERVICE

Service demand for this alternative was estimated by using the model developed earlier in this planning effort and documented in *Southwest Alaska Transportation Plan Travel Demand Forecasts Technical Memorandum* (May 1998). According to this model, AMHS travel demand can be estimated with reference to the following equation:

Annual AMHS Trips = [(0.0154)(2020 Base Population) + (0.000895)(2020 Base Income)] * Annual port calls

Accordingly, this equation was applied to the 2020 populations and incomes of the communities served for which population estimates are available: Old Harbor, Akhiok, Karluk, Larsen Bay, and Ouzinkie. Note that the population of Kodiak, and the communities to which Kodiak is connected by road, are not included in this calculation. This is because the service demand for this alternative is assumed to be generated not by travel from Kodiak to outlying communities, but from the outlying communities to and from Kodiak, the regional hub.

Another caveat is in order. The number of port calls envisioned in this alternative, 154, exceeds the maximum number of port calls in the dataset from which this model was derived statistically. The maximum number of port calls in that dataset is 127. It is not appropriate to assume that the same relationship to port calls will hold beyond the data upon which the model is based. Therefore, rather than multiplying the population and income elements of the equation by the actual number of port calls envisioned, these elements are multiplied against the maximum number of port calls from the dataset, 127. The resulting service demand estimate for this alternative is 7,543 trips per year. Vehicle demand is not estimated for this alternative since the outports of Kodiak Island, which this alternative was designed to serve, are roadless, and therefore would not be expected to generate significant demand for vehicle capacity.

Table 5
Intra-Kodiak Borough Marine Service
Passenger and Vehicle Demand Estimate

Intra-Kodiak Borough Marine Link

	2020 Base Pop	2020 Base Income	Port Calls	Demand
Kodiak*	NA	NA	127	NA
Old Harbor	371	$22,792	127	3,337
Akhiok	110	$22,792	127	2,812
Karluk	47	$22,792	127	2,685
Larsen Bay	121	$22,792	127	2,834
Ouzinkie	322	$22,792	127	3,238
Port O'Brien	NA	$22,792	127	
Port Bailey	NA	$22,792	127	
			SUM	14,907

Passenger demand = trip ends/2 7,453

No significant travel demand is anticipated to be generated from Kodiak, which is the subregional hub to which residents of outlying communities will likely travel to access goods and service. Vehicle demand is not estimated because the outports of Kodiak Island are roadless

ROADWAY DEMAND FORECASTS

Travel demand for roadway projects was estimated based on a model developed for this project. To develop this model, several variables were analyzed to determine which combination of them provided the best "fit" within the admittedly limited Southwest Alaska roadway dataset. The variables ultimately included in the model are population at each end of the highway link in question and the distance of the link. The population of the most populous community is designated as "Population End 1," while the population of the less populous community is designated as "Population End 2." The model can be stated as follows:

$$\text{Annual highway person trips} = (105.13 * \text{Population End 1}) / (\text{Distance}^{0.58}) + (1640.65 * \text{Population End 2}) / (\text{Distance}^{0.58})$$

Table 6
Estimated Demand for Proposed Roadway Links
(Person Trips per Year)

Communities Linked	Demand Estimate
Williamsport–Pile Bay	4,200*
Pedro Bay–Iliamna	17,900
Iliamna–Igiugig	16,100
Igiugig–King Salmon	24,100
Igiugig–Levelock	15,000
Igiugig–Naknek	24,100
South Naknek–Naknek/King Salmon	109,200
King Salmon–Egegik	36,000
Egegik–Pilot Point	20,700
Pilot Point–Ugashik	4,400
Pilot Point–Port Heiden	15,800
Port Heiden–Chigniks	24,800
Chigniks InterVillage Roadway System	118,000
Chigniks–Perryville	23,400
Perryville–Ivanof Bay	14,900

* Based on the Homer–Williamsport marine demand.